

(No Model.)

E. J. BIRD.

LIMEKILN, CUPOLA, AND METALLURGICAL FURNACE.

No. 585,304.

Patented June 29, 1897.

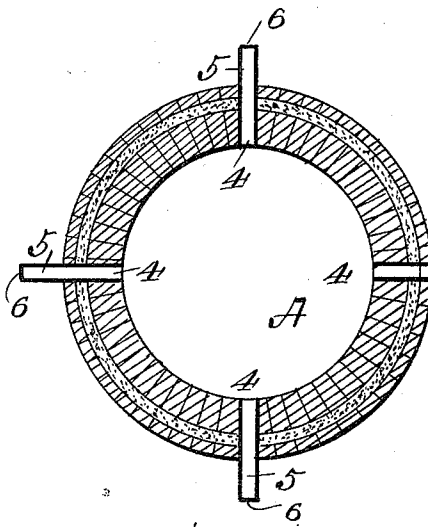


Fig. 2.

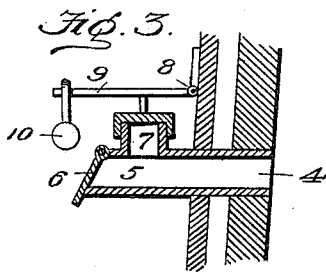


Fig. 3.

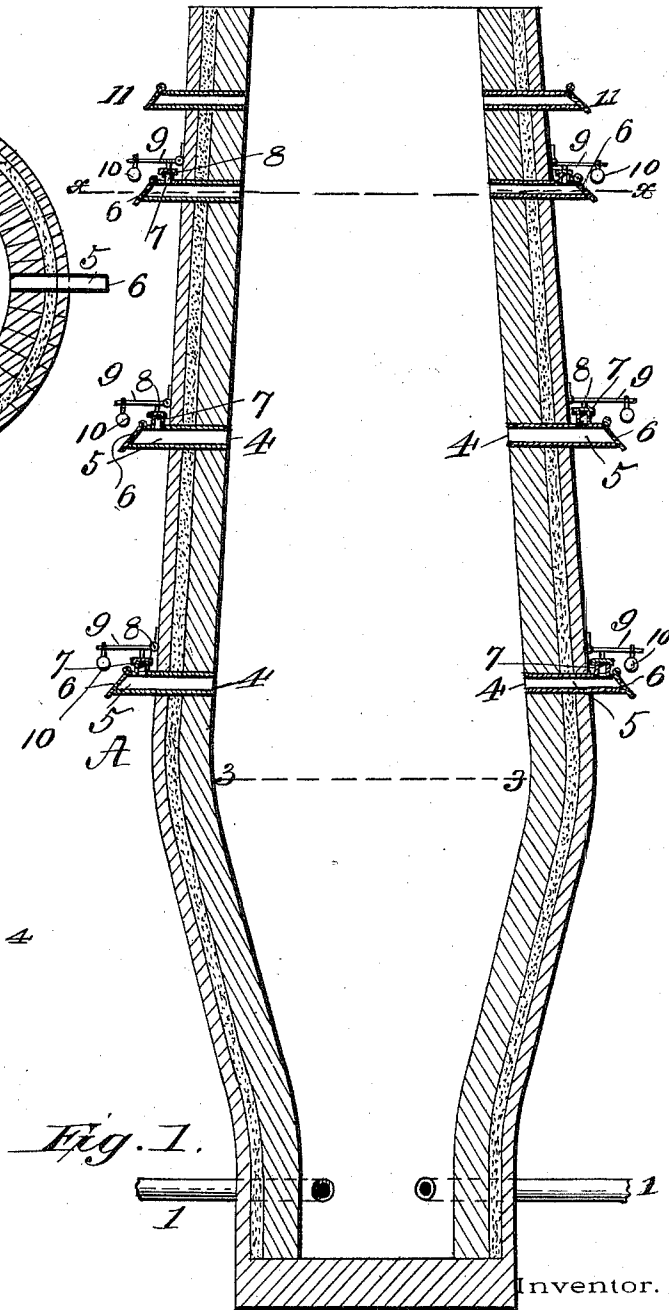


Fig. 1.

Witnesses.
F. L. Oyrand.
A. J. Smith.

Inventor.
Edward James Bird
By *Benj. E. Cunt*
Attorney.

UNITED STATES PATENT OFFICE.

EDWARD JAMES BIRD, OF BIG STONE GAP, VIRGINIA.

LIMEKILN, CUPOLA, AND METALLURGICAL FURNACE.

SPECIFICATION forming part of Letters Patent No. 585,304, dated June 29, 1897.

Application filed May 11, 1896. Serial No. 591,063. (No model.)

To all whom it may concern:

Be it known that I, EDWARD JAMES BIRD, a citizen of the United States, residing at Big Stone Gap, in the county of Wise and State of Virginia, have invented certain new and useful Improvements in Limekiln, Cupola, and Metallurgical Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention has relation to improvements in limekiln, cupola, and metallurgical furnaces of that kind or class wherein the fuel and material to be reduced are placed in successive alternate layers or "scaffolds" and the combustion and reduction are promoted and accomplished by a blast of air admitted at the lower part of the furnace and forced upward through the fuel and charge. In such kilns or furnaces the sections or layers of fuel and reducible material tend to pack and lodge in the cupola above the line or zone of direct reduction, and thus present an impervious mass, bridging the cupola and stopping the passage of the draft, thus retarding combustion, preventing the reduction of the material below, and otherwise materially interfering with the general operation of the kiln or furnace. This occurrence of packing may take place in any one or more than one of the sections or layers, irrespective of the location in the charges in the cupola, and the condition of the packed material may be of less or of greater density and impenetrability, partially or wholly stopping the escape of the gases and products of combustion in their upward course and permitting the accumulation of gases below the packed layers of the charges, tending to occasion dangerous and expensive explosions.

In the present construction of this class of furnaces, so far as I am aware, it is impossible for the furnaceman to ascertain the amount of gas-pressure present in the cupola or furnace, especially at any point therein.

It is therefore the object of my present invention to provide simple and reliable means

for the escape of accumulated gases and to provide means whereby the gases will be automatically discharged at a pressure below that which would endanger the structure, and this I accomplish by the introduction of safety devices at intervals or stated distances in the walls of the furnace or kiln, as hereinafter will be fully specified.

I have fully and clearly illustrated the invention in the accompanying drawings, to be taken as a part of this specification, and wherein—

Figure 1 is a central vertical section of a furnace or kiln embodying my invention. Fig. 2 is a transverse section on the line *xx* of Fig. 1, showing the safety devices arranged at diametrical radii. Fig. 3 is an enlarged detail sectional view of the valves.

Referring to the drawings, A designates a kiln or furnace of any suitable and approved construction adapted to accomplish the purposes for which intended. In the base of the furnace adjacent to the throat and above the hearth are suitably arranged and secured the tuyers 1, through which the blast is introduced in a well-known manner and by any of the usual means. The line or zone of combustion in the furnace is indicated by the line 3 3 in Fig. 1.

At stated intervals or distances in the walls of the furnace are formed horizontally-arranged openings 4, in which are arranged and secured gas-escape pipes 5, the inner ends of which are on a line with the inner surface of the furnace and the outer ends of which project beyond the face of the furnace, substantially as shown, the ends of the pipes being formed inclined, and to the inclined portions are suitably hinged lids or closures 6, constituting safety-valves, which open outward and are of such weight as not to be lifted by the ordinary pressure of the ascending and unimpeded products of combustion, but such that should the gases be impeded and accumulate to an extent to endanger the safety of the structure or that an explosion of the gases takes place the force of the pressure will lift the hinged valves and permit the rapid or forcible exit and escape thereof without damage.

In each of the escape-pipes 5 is formed a valve-seat 7, opening therefrom, in which is

seated a valve 8, the stem of which is engaged by a rod 9, suitably jointed to and supported by the wall of the furnace, and on the rod 9 is mounted a sliding and adjustable weight 10, so that the valve 8 is held down and closed on its seat by the force of the weight on the rod and so that the valve may be raised and opened by the force of the outward pressure of the gas in the pipe. The amount of pressure determined upon to open the valves 8 and allow the escape of the gases is readily regulated by the position of the weight on the rod, the rod being graduated as usual. The valves 8 being set to open at such a fixed pressure as may not be required to lift the safety-valves, their condition can readily be observed by the operator and the amount of pressure within the furnace be indicated at any point subjected to their action.

It is not essential that a pressure-valve be inserted in the topmost escape-pipes, as indicated at 11, because these pipes being adjacent to the top of the furnace it will be perceived that the gases will ordinarily escape through the top of the stack or furnace; but to provide against damage by explosion at this point the pipes are provided with the hinged valves, the same as those of the pipes located below and protecting the body of the furnace. These safety appliances are located within the walls of the furnace on diametrical radii, as shown in Fig. 2 of the drawings, and on the same horizontal plane, so that should the packed material close any one or more of the pipes there may be still one or more escapes for the egress of the gas, and the operator, from the outside, can detect at which point or points the packing process is going on, since if any impediment occur at the inner end of the escape-pipe there will be no pressure indicated on the pressure-valve and consequently no escape of gas therefrom to the outside.

Any suitable scaffolding may be erected about the furnace, so that the workman can examine the condition of the valves and clean out the pipes if they should by any means become choked or stopped up.

Having thus described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In a furnace, a plurality of safety devices disposed at different planes of elevation and communicating with the interior of the furnace, each safety device comprising two

valves, one of which is adapted to be opened before the other by gas-pressure within the furnace.

2. In a furnace, a plurality of gas-escape pipes projected through the walls thereof, closures hinged to the ends of the pipes, and independent pressure-valves in the pipes constructed and arranged to be opened before the closures by gas-pressure within the furnace.

3. In a furnace, a plurality of gas-escape pipes arranged in vertical series, and each number of the series opening on a horizontal plane, closures to shut the outer ends of the pipes, and independent pressure-valves constructed to permit the outlet of gas before the closures are opened by gas-pressure.

4. In a furnace, the combination with the walls thereof formed with openings arranged at different planes of elevation, of gas-escape pipes secured in the openings and projecting therefrom, closures hinged to close the projecting ends of the pipes, and independent pressure-valves seated in the pipes and adjustably-weighted levers to bear on the pressure-valves.

5. In a furnace, the combination of the cupola provided with longitudinally-arranged holes through the walls thereof, escape-pipes secured therein, hinged closures to close the outer ends of the pipes, independent pressure-valves opening into the pipes, and means to adjust the pressure on the pressure-valves, as specified.

6. A furnace formed with a series of openings through its walls, escape-pipes secured in the openings and projecting beyond the outer face of the walls, closures to shut the outer ends of the escape-pipes, and independent safety-valves in the projecting portions of the escape-pipes arranged to open by internal pressure before the closures are lifted, substantially as and for the purpose set forth.

7. A furnace provided with valves constructed and arranged to be opened automatically by internal pressure from the furnace, one set of valves being constructed and arranged to be automatically opened under a less pressure than the other set.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD JAMES BIRD.

Witnesses:

ROBERT P. BARRON,
ROBERT T. IRVINE.